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1 Virtual clay: a real-time sculpting system with haptic toolkits
Kevin T. McDonnell, Hong Qin, Robert A. Wlodarczyk
March 2001 **Proceedings of the 2001 symposium on Interactive 3D graphics**

Full text available: 📄 pdf(2.87 MB)   Additional Information: full citation, references, citings, index terms

2 Volume sculpting
Sidney W. Wang, Arie E. Kaufman
April 1995 **Proceedings of the 1995 symposium on Interactive 3D graphics**

Full text available: 📄 pdf(3.92 MB)   Additional Information: full citation, abstract, references, citings, index terms

We present a modeling technique based on the metaphor of interactively sculpting complex 3D objects from a solid material, such as a block of wood or marble. The 3D model is represented in a 3D raster of voxels where each voxel stores local material property information such as color and texture. Sculpting is done by moving 3D voxel-based tools within the model. The affected regions are indicated directly on the 2D projected image of the 3D model. By reducing the complex operations between ...

3 Computer human interface: A sense of touch in online sculpting
Ian Creighton, Chris Ho-Stuart
June 2004 **Proceedings of the 2nd international conference on Computer graphics and interactive techniques in Austalasia and Southe East Asia**

Full text available: 📄 pdf(258.13 KB)   Additional Information: full citation, abstract, references, index terms

This paper describes the work-in-progress of an online multimedia tool employing the sense of touch in exploring and learning sculpting techniques to be used over the Internet. Many game applications use haptic devices as a control mechanism, yet little has been documented on the use of this controlling procedure in an educational setting. The internet based instructional device presented here has a single modeling tool accessed by a customised interface designed with widely accessible software ...

Keywords: 3D, Internet, education, haptic, multimedia

4 Session D: Geometry: Topology alteration for virtual sculpting using spatial deformation

B. Steyn, J. E. Gain
February 2003 **Proceedings of the 2nd international conference on Computer graphics, virtual Reality, visualisation and interaction in Africa**

Full text available: pdf(530.73 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>

Virtual sculpting enables the creation of computer models by emulating traditional sculpting. It can be implemented using spatial deformation, an interactive versatile modelling technique. Unfortunately, spatial deformation is limited to topology preserving warping. This is overcome by space-time objects, a variant of spatial deformation, which alters topology by *extruding* an object into 4-D, *deforming* the 4-D object and *extracting* a topologically altered object. However, th ...

Keywords: computer graphics, computer modelling, topology alteration, virtual sculpting

5 <u>Moving cursor plane for interactive sculpting</u>
Elvis Ko-Yung Jeng, Zhigang Xiang
July 1996 **ACM Transactions on Graphics (TOG)**, Volume 15 Issue 3

Full text available: pdf(8.11 MB)   Additional Information: <u>full citation</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

Keywords: cursor, depth cue, interactive sculpting, shape cue, visual feedback

6 <u>Haptics: Haptics-based volumetric modeling using dynamic spline-based implicit functions</u>
Jing Hua, Hong Qin
October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

Full text available: pdf(5.78 MB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

This paper systematically presents a novel haptics-based volumetric modeling framework, which is founded upon volumetric implicit functions and powerful physics-based modeling. The volumetric implicit functions incorporate hierarchical B-splines, CSG-based functional composition, and knot insertion to facilitate multiresolution editing and level of details (LODs) control. Our dynamic volumes are semi-algebraic sets of implicit functions and are governed by the principle of dynamics, hence respon ...

7 <u>A procedural approach to authoring solid models</u>
Barbara Cutler, Julie Dorsey, Leonard McMillan, Matthias Müller, Robert Jagnow
July 2002 **ACM Transactions on Graphics (TOG) , Proceedings of the 29th annual conference on Computer graphics and interactive techniques**, Volume 21 Issue 3

Full text available: pdf(11.99 MB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

We present a procedural approach to authoring layered, solid models. Using a simple scripting language, we define the internal structure of a volume from one or more input meshes. Sculpting and simulation operators are applied within the context of the language to shape and modify the model. Our framework treats simulation as a modeling operator rather than simply as a tool for animation, thereby suggesting a new paradigm for modeling as well as a new level of abstraction for interacting with si ...

Keywords: signed-distance function, tetrahedral representation, volumetric modeling

8 Dynamic NURBS with geometric constraints for interactive sculpting

Demetri Terzopoulos, Hong Qin

April 1994 **ACM Transactions on Graphics (TOG)**, Volume 13 Issue 2

Full text available: ⬛ pdf(8.87 MB)   Additional Information: full citation, abstract, references, citings, index terms, review

This article develops a dynamic generalization of the nonuniform rational B-spline (NURBS) model. NURBS have become a defacto standard in commercial modeling systems because of their power to represent free-form shapes as well as common analytic shapes. To date, however, they have been viewed as purely geometric primitives that require the user to manually adjust multiple control points and associated weights in order to design shapes. Dynamic NURBS, or D-NURBS, are physics-based models tha ...

Keywords: CAGD, NURBS, constraints, cross-sectional shape design, deformable models, dynamics, finite elements, free-form deformation, optimal curve and surface fitting, shape metamorphosis, solid rounding, trimming

9 Deformations & shaping: Interactive shape design using volumetric implicit PDEs

Haixia Du

June 2003 **Proceedings of the eighth ACM symposium on Solid modeling and applications**

Full text available: ⬛ pdf(698.18 KB)   Additional Information: full citation, abstract, references, index terms

Solid modeling based on Partial Differential Equations (PDEs) can potentially unify both geometric constraints and functional requirements within a single design framework to model real-world objects via its explicit, direct integration with parametric geometry. In contrast, implicit functions indirectly define geometric objects as the level-set of underlying scalar fields. To maximize the modeling potential of PDE-based methodology, in this paper we tightly couple PDEs with volumetric implicit ...

Keywords: PDE techniques, geometric constraints, implicit functions, scattered data fitting, shape design, volume graphics

10 Two-handed virtual manipulation

Ken Hinckley, Randy Pausch, Dennis Proffitt, Neal F. Kassell

September 1998 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 5 Issue 3

Full text available: ⬛ pdf(1.32 MB)   Additional Information: full citation, abstract, references, citings, index terms

We discuss a two-handed user interface designed to support three-dimesional neurosurgical visualization. By itself, this system is a "point design," an example of an advanced user interface technique. In this work, we argue that in order to understand why interaction techniques do or do not work, and to suggest possibilities for new techniques, it is important to move beyond point design and to introduce careful scientific measurement of human behavioral principles. In particula ...

Keywords: bimanual asymmetry, haptic input, input devices, three-dimensional interaction, two-handed interaction, virtual manipulation

11 Sketching as a solid modeling tool

Lynn Eggli, Beat D. Brüderlin, Gershon Elber

December 1995 **Proceedings of the third ACM symposium on Solid modeling and applications**

Full text available: pdf(771.55 KB)   Additional Information: full citation, references, citings, index terms

12 Teddy: a sketching interface for 3D freeform design
Takeo Igarashi, Satoshi Matsuoka, Hidehiko Tanaka
July 1999 **Proceedings of the 26th annual conference on Computer graphics and interactive techniques**
Full text available: pdf(289.82 KB)   Additional Information: full citation, references, citings, index terms

Keywords: 3D modeling, chordal axes, design, gestures, inflation, pen-based systems, sketching

13 Pointing and manipulation: An interface for creating and manipulating curves using a high degree-of-freedom curve input device
Tovi Grossman, Ravin Balakrishnan, Karan Singh
April 2003 **Proceedings of the conference on Human factors in computing systems**
Full text available: pdf(2.00 MB)   Additional Information: full citation, abstract, references, index terms

Current interfaces for manipulating curves typically use a standard point cursor to indirectly adjust curve parameters. We present an interface for far more direct manipulation of curves using a specialized high degree-of-freedom curve input device, called ShapeTape. This device allows us to directly control the shape and position of a virtual curve widget. We describe the design and implementation of a variety of interaction techniques that use this curve widget to create and manipulate other v ...

Keywords: curve editing, high degree-of-freedom input

14 Interactive curve design using digital French curves
Karan Singh
April 1999 **Proceedings of the 1999 symposium on Interactive 3D graphics**
Full text available: pdf(1.05 MB)   Additional Information: full citation, references, citings, index terms

15 CavePainting: a fully immersive 3D artistic medium and interactive experience
Daniel F. Keefe, Daniel Acevedo Feliz, Tomer Moscovich, David H. Laidlaw, Joseph J. LaViola
March 2001 **Proceedings of the 2001 symposium on Interactive 3D graphics**
Full text available: pdf(1.23 MB)   Additional Information: full citation, references, citings, index terms

Keywords: 3D modeling, 3D painting, Cave, gestures, tangible user interface

16 Describing free-form 3D surfaces for animation
Eben Ostby
January 1987 **Proceedings of the 1986 workshop on Interactive 3D graphics**
Full text available: pdf(674.62 KB)   Additional Information: full citation, abstract, references, citings, index terms

A system for interactively describing and modifying free-form surfaces is presented. The

system is based on the use of bicubic patches. Although it is not a full-fledged mechanical CAD system, it has been used to construct complex surface descriptions. It is also useful as a testbed for further experimentation.

17 Representation and extraction of volumetric attributes using trivariate splines: a mathematical framework
William Martin, Elaine Cohen
May 2001 **Proceedings of the sixth ACM symposium on Solid modeling and applications**

Full text available: pdf(625.49 KB)   Additional Information: full citation, abstract, references, citings, index terms

Our goal in this paper is to leverage traditional strengths from the geometric design and scientific visualization communities to produce a tool valuable to both. We present a method for representing and specifying attribute data across a trivariate NURBS volume. Some relevant attribute quantities include material composition and density, optical indices of refraction and dispersion, and data from medical imaging. The method is independent of the granularity of the physical geometry, allowing ...

Keywords: isosurfacing, level sets, trivariate volume, visualization

18 Poster session: Free-form deformations via sketching and manipulating scalar fields
Jing Hua, Hong Qin
June 2003 **Proceedings of the eighth ACM symposium on Solid modeling and applications**

Full text available: pdf(607.19 KB)   Additional Information: full citation, abstract, references, index terms

This paper presents a novel Scalar-field based Free-Form Deformation (SFFD) technique founded upon general flow constraints and implicit functions. In contrast to the traditional lattice-based FFD driven by parametric geometry and spline theory, we employ scalar fields as embedding spaces instead. Upon the deformation of the scalar field, the vertices will move accordingly, which result in free-form deformations of the embedded object. The scalar field construction, sketching, and manipulation a ...

Keywords: deformations, interaction techniques, scalar fields

19 Shape modeling with point-sampled geometry
Mark Pauly, Richard Keiser, Leif P. Kobbelt, Markus Gross
July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Full text available: pdf(12.09 MB)   Additional Information: full citation, abstract, references, citings

We present a versatile and complete free-form shape modeling framework for point-sampled geometry. By combining unstructured point clouds with the implicit surface definition of the moving least squares approximation, we obtain a hybrid geometry representation that allows us to exploit the advantages of implicit and parametric surface models. Based on this representation we introduce a shape modeling system that enables the designer to perform large constrained deformations as well as boolean op ...

Keywords: boolean operations, dynamic sampling, free-form deformation, point-sampled geometry, shape modeling

20 Computers, complexity, and the Statue of Liberty restoration
Karen A. Frenkel

April 1986 **Communications of the ACM**, Volume 29 Issue 4

Full text available: pdf(2.11 MB)   Additional Information: full citation, abstract, index terms, review

Twentieth-century techniques such as computer-aided engineering and finite-element analysis were used to restore the nineteenth-century monument.

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1 Representations for Rigid Solids: Theory, Methods, and Systems
Aristides G. Requicha
December 1980 **ACM Computing Surveys (CSUR)**, Volume 12 Issue 4

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1 A design/constraint model to capture design intent
Chia-Hui Shih, Bill Anderson
May 1997 **Proceedings of the fourth ACM symposium on Solid modeling and applications**
Full text available: ▣ pdf(1.06 MB)   Additional Information: full citation, references, citings, index terms

2 Solid modeling with Scheme
Edward C. Martin
March 1995 **ACM SIGCSE Bulletin , Proceedings of the twenty-sixth SIGCSE technical symposium on Computer science education**, Volume 27 Issue 1
Full text available: ▣ pdf(438.23 KB)   Additional Information: full citation, references, citings, index terms

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1 Design and performance evaluation of new massively parallel VLSI mask verification algorithms in JIGSAW   ▬
Erik C. Carlson, Rob A. Rutenbar
January 1991 **Proceedings of the 27th ACM/IEEE conference on Design automation**

Full text available: 🗎 pdf(1.06 MB)   Additional Information: full citation, abstract, references, index terms

This paper describes JIGSAW, the massively parallel mask checking system that has evolved from our earlier feasibility study on large-scale, fine-grain parallelism in simple mask checking tasks [1]. Unlike previous systems, JIGSAW parallelizes all phases of the checking process. We describe new techniques to handle all-angle geometry, the first massively parallel mask flattening and multi-layer netlist extraction algorithms, and measurements made comparing JIGSAW, running on a Connection Ma ...

2 Volume sculpting   ▬
Sidney W. Wang, Arie E. Kaufman
April 1995 **Proceedings of the 1995 symposium on Interactive 3D graphics**

Full text available: 🗎 pdf(3.92 MB)   Additional Information: full citation, abstract, references, citings, index terms

We present a modeling technique based on the metaphor of interactively sculpting complex 3D objects from a solid material, such as a block of wood or marble. The 3D model is represented in a 3D raster of voxels where each voxel stores local material property information such as color and texture. Sculpting is done by moving 3D voxel-based tools within the model. The affected regions are indicated directly on the 2D projected image of the 3D model. By reducing the complex operations between ...

3 Towards modeling individual and collaborative construction of jigsaws using task knowledge structures (TKS)   ▬
Hilary Johnson, Joanne Hyde
December 2003 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 10 Issue 4

Full text available: 🗎 pdf(410.91 KB)   Additional Information: full citation, abstract, references, index terms

Recent years have seen an overwhelming interest in how people work together as a group. Both the nature of collaboration and research into how people collaborate is complex and multifaceted, with different research agendas, types of studies, and variations in the behavioral data collected. A better understanding of collaboration is needed in order to be able to make contributions to the design of systems to support collaboration and

collaborative tasks. In this article, we combine relevant liter ...

Keywords: Modeling, collaborative studies, task analysis

4   A procedural approach to authoring solid models
    Barbara Cutler, Julie Dorsey, Leonard McMillan, Matthias Müller, Robert Jagnow
    July 2002 **ACM Transactions on Graphics (TOG) , Proceedings of the 29th annual
             conference on Computer graphics and interactive techniques**, Volume 21 Issue 3
    Full text available: 📄 pdf(11.99 MB)   Additional Information: full citation, abstract, references, citings, index
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    We present a procedural approach to authoring layered, solid models. Using a simple
    scripting language, we define the internal structure of a volume from one or more input
    meshes. Sculpting and simulation operators are applied within the context of the language
    to shape and modify the model. Our framework treats simulation as a modeling operator
    rather than simply as a tool for animation, thereby suggesting a new paradigm for modeling
    as well as a new level of abstraction for interacting with si ...

    Keywords: signed-distance function, tetrahedral representation, volumetric modeling

5   Poster Session: Application of feature technology to modeling and dimensioning the
    intermediate geometry of automotive powertrain components
    Madhumati Ramesh, Debasish Dutta, Nagesh Belludi, Derek Yip-Hoi, Paul Wascher
    June 2002 **Proceedings of the seventh ACM symposium on Solid modeling and
             applications**
    Full text available: 📄 pdf(409.66 KB)   Additional Information: full citation, abstract, references, index terms

    Intermediate parts occur in between process steps during machining. In case of parts
    produced in high volumes, a detail documentation of intermediate geometry is required for
    the knowledge of operators, for gauging, as a specification for tooling design and for offline
    CMM programming & simulation. Currently, manually created approximate 2D drawings
    and/or manually created 3D models are used for representing the intermediate geometry.
    The commercial process planning systems provide NC code simul ...

    Keywords: features, process planning, solid modeling

6   Haptics: Haptics-based volumetric modeling using dynamic spline-based implicit
    functions
    Jing Hua, Hong Qin
    October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and
             graphics**
    Full text available: 📄 pdf(5.78 MB)   Additional Information: full citation, abstract, references, citings, index
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    This paper systematically presents a novel haptics-based volumetric modeling framework,
    which is founded upon volumetric implicit functions and powerful physics-based modeling.
    The volumetric implicit functions incorporate hierarchical B-splines, CSG-based functional
    composition, and knot insertion to facilitate multiresolution editing and level of details
    (LODs) control. Our dynamic volumes are semi-algebraic sets of implicit functions and are
    governed by the principle of dynamics, hence respon ...

7   Feature operations using selective Boolean
    Biplab Sarkar, Navin Pai, Sunit Mangalvedhekar
    May 1997 **Proceedings of the fourth ACM symposium on Solid modeling and**

applications

Full text available: pdf(867.83 KB)   Additional Information: full citation, references, index terms

Keywords: Boolean operators, feature—extent, intersection graph, profile—based features, selective Boolean

8 Atomizer: a dynamic atomicity checker for multithreaded programs

Cormac Flanagan, Stephen N Freund

January 2004 **ACM SIGPLAN Notices , Proceedings of the 31st ACM SIGPLAN-SIGACT symposium on Principles of programming languages**, Volume 39 Issue 1

Full text available: pdf(195.13 KB)   Additional Information: full citation, abstract, references, citings, index terms

Ensuring the correctness of multithreaded programs is difficult, due to the potential for unexpected interactions between concurrent threads. Much previous work has focused on detecting race conditions, but the absence of race conditions does not by itself prevent undesired thread interactions. We focus on the more fundamental non-interference property of *atomicity*; a method is atomic if its execution is not affected by and does not interfere with concurrently-executing threads. Atomic me ...

Keywords: atomicity, dynamic analysis, reduction

9 Model Simplification: Reconstruction of feature volumes and feature suppression

Sashikumar Venkataraman, Milind Sohoni

June 2002 **Proceedings of the seventh ACM symposium on Solid modeling and applications**

Full text available: pdf(522.46 KB)   Additional Information: full citation, abstract, references, citings, index terms

This paper describes a systematic algorithm for reconstructing the feature volume from a set of faces in a solid model. This algorithm serves a dual purpose. Firstly, the algorithm generates the feature volume by extending or contracting the neighboring faces of the set of faces. Secondly, the algorithm may also be used to remove (or suppress) the face-set from the model. The algorithm uses a divide-and-conquer strategy and geometric cues to identify the correct topology. It robustly handles a w ...

Keywords: delete faces, feature suppression, feature volume reconstruction

10 Dissertation Abstracts in Computer Graphics

Clifford A. Shaffer

September 1993 **ACM SIGGRAPH Computer Graphics**, Volume 27 Issue 2

Full text available: pdf(1.47 MB)   Additional Information: full citation

11 Reconstruction of 3D virtual buildings from 2D architectural floor plans

Clifford So, George Baciu, Hanqiu Sun

November 1998 **Proceedings of the ACM symposium on Virtual reality software and technology**

Full text available: pdf(2.10 MB)   Additional Information: full citation, references, citings, index terms

Keywords: 3D extrusion, architectural design, floor plan, virtual reality modeling

12 Two-handed virtual manipulation
Ken Hinckley, Randy Pausch, Dennis Proffitt, Neal F. Kassell
September 1998 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 5 Issue 3

Full text available: pdf(1.32 MB)   Additional Information: full citation, abstract, references, citings, index terms

We discuss a two-handed user interface designed to support three-dimesional neurosurgical visualization. By itself, this system is a "point design," an example of an advanced user interface technique. In this work, we argue that in order to understand why interaction techniques do or do not work, and to suggest possibilities for new techniques, it is important to move beyond point design and to introduce careful scientific measurement of human behavioral principles. In particula ...

Keywords: bimanual asymmetry, haptic input, input devices, three-dimensional interaction, two-handed interaction, virtual manipulation

13 Traits: Tools and Methodology
May 2004 **Proceedings of the 26th International Conference on Software Engineering**

Full text available: pdf(839.73 KB)
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Traits are an object-oriented programming language constructthat allow groups of methods to be named and reusedin arbitrary places in an inheritance hierarchy. Classes canuse methods from traits as well as defining their own methodsand instance variables. Traits thus enable a new styleof programming, in which traits rather than classes are theprimary unit of reuse. However, the additional sub-structureprovided by traits is always optional: a class written usingtraits can also be viewed as a flat ...

14 Virtual clay: a real-time sculpting system with haptic toolkits
Kevin T. McDonnell, Hong Qin, Robert A. Wlodarczyk
March 2001 **Proceedings of the 2001 symposium on Interactive 3D graphics**

Full text available: pdf(2.87 MB)   Additional Information: full citation, references, citings, index terms

15 Segmented ray casting for data parallel volume rendering
William M. Hsu
November 1993 **Proceedings of the 1993 symposium on Parallel rendering**

Full text available: pdf(955.68 KB)   Additional Information: full citation, references, citings, index terms

Keywords: volume rendering

16 Pointing and manipulation: An interface for creating and manipulating curves using a high degree-of-freedom curve input device
Tovi Grossman, Ravin Balakrishnan, Karan Singh
April 2003 **Proceedings of the conference on Human factors in computing systems**

Full text available: 🗎 pdf(2.00 MB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>

Current interfaces for manipulating curves typically use a standard point cursor to indirectly adjust curve parameters. We present an interface for far more direct manipulation of curves using a specialized high degree-of-freedom curve input device, called ShapeTape. This device allows us to directly control the shape and position of a virtual curve widget. We describe the design and implementation of a variety of interaction techniques that use this curve widget to create and manipulate other v ...

Keywords: curve editing, high degree-of-freedom input

17 <u>Applying traits to the smalltalk collection classes</u>

Andrew P. Black, Nathanael Schärli, Stéphane Ducasse
October 2003 **ACM SIGPLAN Notices , Proceedings of the 18th ACM SIGPLAN conference on Object-oriented programing, systems, languages, and applications**, Volume 38 Issue 11

Full text available: 🗎 pdf(335.91 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>, <u>review</u>

Traits are a programming language technology that promote the reuse of methods between unrelated classes. This paper reports on a refactoring of the Smalltalk collections classes using traits. The original collection classes contained much duplication of code; traits let us remove all of it. We also found places where the protocols of the collections lacked uniformity; traits allowed us to correct these non-uniformities *without* code duplication.Traits also make it possible to reuse fragme ...

Keywords: collection hierarchy, inheritance, mixins, multiple Inheritance, refactoring, reuse, smalltalk, stream classes, traits

18 <u>Enhanced operational semantics: a tool for describing and analyzing concurrent systems</u>

Pierpaolo Degano, Corrado Priami
June 2001 **ACM Computing Surveys (CSUR)**, Volume 33 Issue 2

Full text available: 🗎 pdf(355.24 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

This article surveys the definition and application of an enhancement of structural operational semantics in the field of concurrent systems, and also addresses issues of distribution and mobility of code. The focus is on how enriching the labels of transitions with encodings of their deduction trees is sufficient to derive qualitative and quantitative information on the systems in hand simply by relabeling the transitions of a unique concrete model.

Keywords: parametric models, process algebra

19 <u>Representation and extraction of volumetric attributes using trivariate splines: a mathematical framework</u>

William Martin, Elaine Cohen
May 2001 **Proceedings of the sixth ACM symposium on Solid modeling and applications**

Full text available: 🗎 pdf(625.49 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

Our goal in this paper is to leverage traditional strengths from the geometric design and

scientific visualization communities to produce a tool valuable to both. We present a method for representing and specifying attribute data across a trivariate NURBS volume. Some relevant attribute quantities include material composition and density, optical indices of refraction and dispersion, and data from medical imaging. The method is independent of the granularity of the physical geometry, allowing ...

Keywords: isosurfacing, level sets, trivariate volume, visualization

[20] Free-form deformations with lattices of arbitrary topology
Ron MacCracken, Kenneth I. Joy
August 1996 **Proceedings of the 23rd annual conference on Computer graphics and interactive techniques**
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